From the equatorial co-ordinates, the photometric data, and the period-luminosity law we derive:

Galactic longitude	296°
Galactic latitude	+57°
Median apparent visual magnitude	10.3
Logarithm of the period	1.237
Absolute visual magnitude	−4.0
Radial distance from the Sun ..... parsecs	7,100
Distance projected on the galactic plane ..... parsecs	3,900
Distance from the galactic plane ..... parsecs	+6,000

From these results it appears that W *Virginis* is not only the most remote galactic Cepheid for which a distance has been definitely estimated, but is also at the greatest distance from the galactic plane as yet found for any isolated star.

HARLOW SHAPLEY

THE PARALLAXES OF N. G. C. 40 AND N. G. C. 2022.

The parallaxes of these two planetary nebulae were recently determined from 14 and 16 exposures, respectively. The results are:

$$\text{N. G. C. } 40 \quad \pi_{\text{rel}} = 0''.000 \pm 0''.003$$
$$\text{N. G. C. } 2022 \quad \pi_{\text{rel}} = +0''.008 \pm 0''.004$$

To obtain absolute parallaxes about 0″.002 should be added to the relative values. The angular diameters given by Curtis are 60″ and 28″; his estimates of the photographic magnitude of the central stars are 10 and 13.

A. VAN MAANEN.

THE SPECTRUM OF THE COMPANION TO CASTOR AND OF W. B. 16^h 906.

Common proper motion of 0″.20 links the 9.5 magnitude companion to *Castor* ($7^h28^m.2$, +32°.6′: 1900) altho its distance is 73″. Also Fox[1] has found the parallax to be 0″.114, which is comparable with, 0″.075, the mean found by several observers for the components of *Castor* itself.

The spectrum of the companion has been photographed at this observatory for determining its absolute magnitude and parallax. Plates taken in 1916 with the 7-inch camera and 60-inch telescope indicated that the star was a binary of late type with both com-

[1] *C. R.* **168**, 1096.

ponents showing and with bright hydrogen lines but the greater dispersion available with the 100-inch reflector has made it possible to analyze the spectrum with much more certainty.

It is now evident that the components of the binary are nearly alike in type and of equal brightness. The spectra are characteristic of dwarf K_8 type except that hydrogen has sharp bright lines in both. The H and K lines of calcium are also bright but on account of the weakness of the spectra in the violet portions we cannot be certain that they show in both stars.

There are traces of the M type bands but they are hardly strong enough to place the star in class M. The spectrum differs in many respects from that of the Md type variables of long period, which are probably giant stars. The bright hydrogen lines have the same displacement as the absorption lines and $H\beta$ is stronger than $H\gamma$. So far as we know there has been no suspicion of variability of its light altho it has doubtless been seen very often by double star observers and others in setting on *Castor*.

The few plates so far obtained seem to indicate that the period of the binary is surprisingly short for a late type star. Photographs taken on successive nights give the complete ranges from single lines or superimposed spectra to a separation of 230^{km} in the lines of the two components. It is apparent that the period must be as short as four or five days unless the eccentricity is unexpectedly large. It is hoped that sufficient plates may be obtained to determine its orbit at least approximately.

The radial velocity from one plate taken with the 100-inch telescope and 18-inch camera when the spectra seemed to coincide best measured $+3^{km}$ which agrees with the mean of the velocities of -1.0^{km} and $+6.2^{km}$ for the center of mass of α_1 and α_2 *Geminorum*.[2]

The absolute magnitude of each component of the companion as determined from the spectrum is 9.5. The combined apparent magnitude is 8.6 or 9.4 for each star, supposing them to be of equal brightness. We would then have $0''.105$ for the spectroscopic parallax which confirms the trigonometric parallax.

The proper motion, parallax and radial velocity altogether make it certain that the faint companion in some way belongs to the *Castor* group in spite of its considerable distance, which must be of the order of 1000 astronomical units.

[2]Curtis, *L. O. B.*, **4**, 55.

We then have in this interesting system three visible stars whose apparent magnitudes are 2.8, 2.0 and 9.5. The two bright stars have spectra nearly alike of type A_0 and their intrinsic brightness places them among the brighter stars of that class. They form the well known visual pair Σ 1110, whose period has been computed to be 347 years[3] and whose distance is about 6″. Each of the three visible stars is itself a spectroscopic binary, the periods being 2.9, 9.2 and 4± days respectively. There is a remarkable range of mass, spectrum, luminosity and orbital character in the different members of the group.

The only other star of low luminosity and late type of spectrum with bright hydrogen lines which has come to our knowledge is W. B. 16^h 906=B. D.$-8°$ 4352 ($16^h50^m.1$, $-8°9'$: 1900, $8^m.8$). Except for the bright lines this star would be classified as Ma with fairly strong bands. It has a large proper motion of 1″.27 and a measured trigonometric parallax of 0″.150. The low luminosity lines are exceedingly strong, giving a spectroscopic parallax[4] of 0″.174. The general characteristics of the spectrum are of the dwarf type similar to that of the companion to *Castor*. Its radial velocity determined from low dispersion plates is $+3^{km}$ and appears to be constant.

In order to determine whether or not there might be changes in its spectrum or brightness Miss Cannon at our suggestion kindly examined the Harvard plates of this star. She found the spectrum on a number of plates but, on account of the faintness of the star, the emission lines were uncertain on many of the plates and she could not be sure of the invariability of its spectrum. Her classification was K_5. On 28 Harvard Chart plates from 1899 to 1919 there was "no appreciable variation" in magnitude.

The Mt. Wilson photographs taken in 1914, 1916 and 1917 show no variation in the spectrum. The hydrogen lines are sharp bright lines on all of the plates, Hβ being the strongest of the series. None of the plates is strong enough to show the H and K lines of calcium.

W. S. Adams.
A. H. Joy.

[3] Doberck, *A. N.* **166**, 145.
[4] *Contributions of the Mt. Wilson Observatory* No. 142.